THE ENGINEER.

The British Industries Fair at Birmingham.

The British Industries Fair.

THE British Industries Fair, which opens on Monday, February 17th, and closes on the 28th inst., will undoubtedly be the largest that has yet been brought together. The buildings in which it is housed at Birmingham have been greatly extended and the scope of the exhibits enlarged.

It is not possible, before the Show opens, to give a general impression of its appearance, but we give below particulars of some of the exhibits which visitors may be assured of finding there. These notes are such as have come to our hand and are not dealt with in any other order but that which suits our convenience. We hope to give some more detailed account of the Fair in our next issue.

Among the official visits, conferences, luncheons, &c., which will take place during the Fair that may interest engineers there will be those of several gas societies and the Plumbing and Domestic Engineers on February 19th; the Ironmongers' Federation and the principal electrical societies on February 20th; the local section of the Civil Engineers, the Institute of Mining Engineers, the Institute of Metals and the Institute of Welding Engineers on February 21st; the Institution of Electrical Engineers and the Association of Engineering and Shipbuilding Draughtmen on February 22nd; the British Cast Iron Research Association, the Institute of British Foundrymen and the Heating and Ventilating Engineers on February 24th; the Mechanical Engineers and the British Engineering Association on February 25th; several ironmongers societies on February 26th; a number of other electrical societies on February 27th; and the Institute of Quarrying on February 28th.

BULPITT AND SONS, LTD.

Modern examples of electric water heaters of the storage type which do not demand a big peak current, but which only give rise to relatively light loads spread over comparatively long periods, will be shown by Bulpitt and Sons, Ltd., of Swansea Works, Birmingham. The consumption of the firm's 10-gallon heater is only 0·75 kW, whilst that of a 15-gallon tank is 1 kW. The heaters are well adapted to take full advantage of any special tariffs which apply to schemes of charges operative in certain districts. The temperature is adjustable by means of a thermostat and can be varied between 120 deg. and 200 deg. Fah. while the temperature control is within 2 deg. or 3 deg. of the figure for which the thermostat is set. In order to ensure long life an immersion heater, working at a relatively low heat, is employed and is so designed that it may readily be removed from the heater. A plate at the base of the inner container carries the whole of the fittings, such as the water inlet and non-return valve, heater thermostat and porcelain terminal block. The plate is removable and allows access to the inside of the container for the purpose of cleaning or scaling. A covering cap encloses all the controls and gives the tank a clean outline without pockets to trap dust. In the case of one type of tank suitable for pressure service, the cold water feed is taken from the usual cistern at the top of the building or from the mains, the hot water being led off from the top or bottom of the heater to the required spot, and being controlled by stop cocks at the outlets. In the case of another heater there is a free outlet for the water, a stop cock being provided on the cold water inlet pipe only. A special "syphon" outlet keeps the water level below the outflow and eliminates the objectional drip commonly experienced as the tank heats up and the water expands.

MONEL-WEIR, LTD.

The stand of Monel-Weir, Ltd., Cathcart, Glasgow, will be, we think, a striking epitome of the range and diversity of applications of Monel metal and pure malleable nickel. The feature of these metals is, of course, their combination of toughness and strength, ornamental appearance and resistance to corrosion. A new alloy is also to be shown, marketed under the name "Nickel-Chromium-Iron." This alloy is resistant to nitric acid, and the mixed acids used in nitration processes. It is described by the makers as a super-stainless steel, in that it combines the advantages of the earlier stainless steels with definitely enhanced corrosion resistance and considerably greater ease of fabrication. "Nimol," a new cast iron alloy, containing about 20 per cent. Monel metal, possesses pronounced resistance to heat oxidation up to 600 deg. Cent., and is free from the destructive growth which characterises normal cast iron. It is essentially a cast material. A model marine condenser, with full-size tubes illuminated internally, is to be on view in order to show the standard of manufacture now attained. Grouped round it will be pumps fitted with Monel metal rods, valves, &c., and some high-speed turbine-driven feed pumps.

MARSHALL, SONS AND CO., LTD.

The stand of Marshall, Sons and Co., Ltd., Gainsborough, will, we are told, be noteworthy on account of its extent and the variety of the exhibits shown thereon. Thus there will be a 16 B.H.P. semi-Diesel oil engine, two full Diesel, cold-starting horizontal engines of 25 and 30 B.H.P., and one two-cylinder vertical medium-compression engine of 60 B.H.P. Besides these there will be an oil engine-driven road roller, a concrete mixer, and an example of the "Manumit" roller, which we mentioned briefly in our issue of November 22nd last. We now reproduce two illustrations of the interior mechanism of this machine in Figs. 1 and 2.

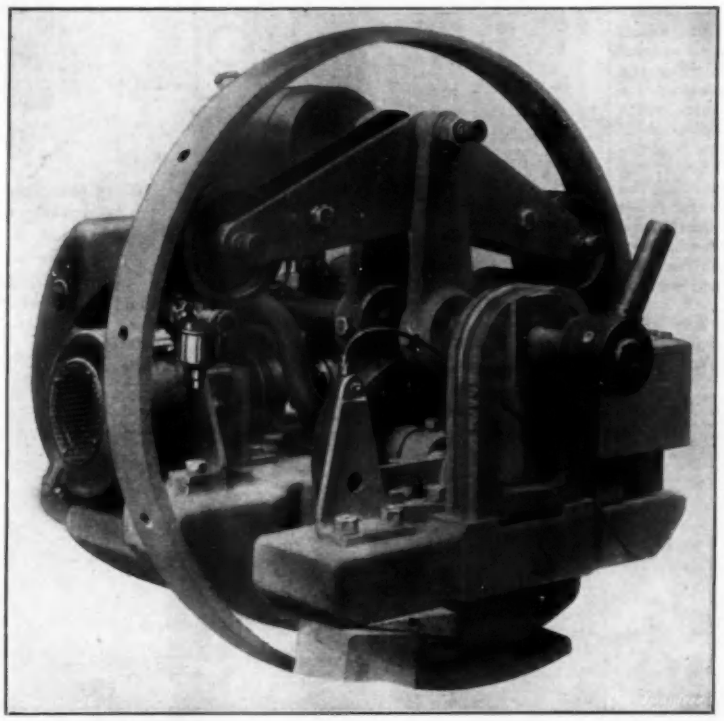


FIG. 1—MECHANISM OF "MANUMIT" ROLLER—MARSHALL

The "Manumit" roller, it will be remembered, resembles the ordinary garden roller in exterior appearance, although it is much larger, being made in two sizes of 12 cwt. and 1 ton; but it contains, within its roller, an engine for its propulsion. This petrol engine is of 1½ horse-power in the smaller size and of 3½ horse-power for the larger set. It can be seen towards the left in the background of our illustrations, and is air cooled, the most prominent feature being the fan used for this purpose. The air used for combustion is passed through a cleaner, so that grit shall not enter the cylinder.

The engine, it will be observed, is set transversely to the axis of the roller, and on the right there is a speed-reducing worm gear. This gear is totally enclosed in an oil bath and has a hardened steel worm with a phosphor-bronze wheel, both of which are accurately ground. This gear drives the friction wheel which can just be seen above the main central shaft in Fig. 2, and this wheel in turn drives another one below. For transmitting the drive to the roller there are two idlers on a yoke, which forms a prominent feature in both of the illustrations. This yoke is carried on an arm keyed to the main axle, to which also is fixed the handle used to guide the roller. The handle is represented in both engravings by a mere stump. The function of these idlers is to jamb between either one or the other of the two friction wheels already mentioned, and the large exterior ring, so as to transmit the drive to the roller. In Fig. 1 both the idlers are shown out of engagement, when the roller naturally remains stationary. In Fig. 2 the lower idler has been brought into engagement with the second friction wheel by the depression of the guiding handle and the roller will travel in one direction. By reversing the handle to the opposite side the other idler is brought into contact with the first friction wheel and the roller proceeds in the opposite direction. All this gear, the engine, its petrol tank, the transmission and so forth are slung on bearings from the main shaft of the roller on a heavy base which provides the reaction necessary for the driving torque. There is also beneath the base a heavy shoe, which can be released to act as a brake on the interior of the roller; but generally the engine, when throttled down, can keep the roller in charge. The lubrication of the engine is effected by the addition of a small proportion of lubricating oil to the petrol which it consumes, and that of the transmission gear by the oil bath already referred to, while the minor bearings have Stauffer lubricators. The size of the 12-cwt. roller is 2ft. 7½in. in diameter by 2ft. 6in. wide, and of the 20-cwt. size 2ft. 10½in. by 2ft. 11in.

In Figs. 3 and 4 we give two views of one of the two horizontal oil engines to be exhibited. These engines are of the four-stroke cycle type, with solid injection, and will start directly when cold. As will be seen from the illustrations, the inlet and exhaust valves are arranged one above the other, and are operated by a single cam on the side shaft. The inlet valve casing, together with the inlet silencer, is easily removable, so that the seatings of both valves can be attended to. These engines are made in six sizes of from 15 to 50 horse-power, running at speeds of from 330 revolutions per minute down to 250 revolutions per minute. The oil-driven road roller resembles, to a large extent, the standard Marshall steam roller,

but is driven by a horizontal two-stroke valveless oil engine. The transmission is effected on the five-shaft principle, and three speeds of 1·1, 1·6 and 3 miles per hour are provided. The hubs and spokes of the roller wheels of these engines are made in one as a

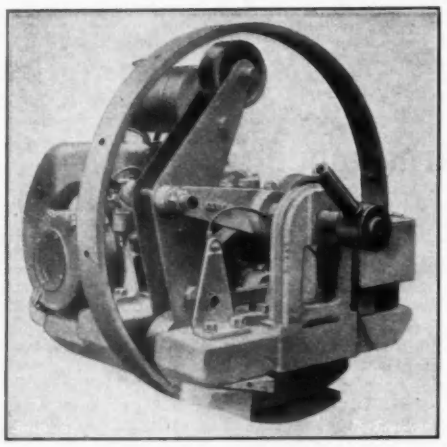


FIG. 2—"MANUMIT" ROLLER—MARSHALL

steel casting and the cast iron rim is bolted on, so that it is easily renewable.

ALLDAYS AND ONIONS, LTD.

On the stand of Alldays and Onions, Ltd., Small Heath, Birmingham, there will be exhibited several items in foundry and smithy equipment. For the foundry there will be shown the furnace portion of a cupola, together with geared crane ladles suitable for iron and steel, the latter being of the bottom-pouring type. A tilting crucible furnace to be shown is of the straight line pouring type arranged for oil firing, but can also be supplied for gas fuel. For providing the blast for cupolas, &c., Roots blowers of several types and also centrifugal fans of the high-pressure type are to be on view. For the smithy there will be a modern type of down-draught hearth, with a self-contained electric blowing fan, and independent fans for supplying blast to a range of hearths. A 3-cwt. pneumatic forging hammer arranged for belt drive will illustrate a range up to 10-cwt. capacity. A pneumatic planishing hammer, suitable for panel beating, coppersmiths, &c., is to be at work. Riveting hammers of similar arrangement are made by this firm.

COCHRAN AND CO. (ANNAN), LTD.

The more important of the exhibits by Cochran and Co. (Annan), Ltd., of Annan, Scotland, will be a standard Cochran vertical boiler 7ft. in diameter by 15ft. high, which will be at work heating part of the Fair buildings. It has 600 square feet of heating surface, works at a pressure of 100 lb. per square inch, and is fitted with a Crosthwaite forced-draught furnace. This boiler was supplied to the Fair last year, on permanent loan and, consequently, will be familiar to many visitors, so that it is unnecessary to enlarge upon its characteristics here. The little Cochranette boiler which we illustrate in Figs. 5 and 6 is, however, comparatively novel. It is

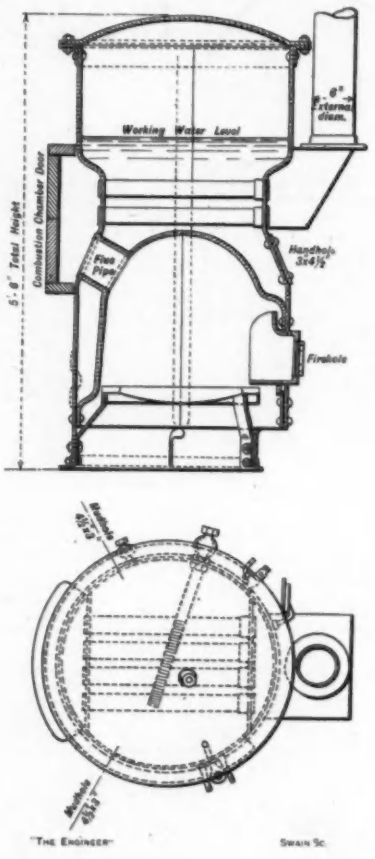


FIG. 5—COCHRANETTE BOILER

the smallest boiler made by this company and has a maximum steaming capacity of about 200 lb. per hour. The chief difference between this little boiler and the standard Cochran, except as regards dimensions, is the crown of the shell, which, it will be seen, is dished, instead of being a hemisphere, and is bolted in place. The object of this change in design is to give free access to the interior of the boiler for cleaning purposes, as in such sizes the ordinary manhole is quite inadequate. Otherwise, the boiler retains the characteristics of its prototype, which eliminate an internal uptake liable to corrosion at the working water level, and the liability of overheating, as the heating surface is well below the water level. There are no riveted seams, liable to leakage, in contact with the fire, and the combustion chamber is brick-lined. The boiler is built of Lloyd's tested plates and has the following leading dimensions:—Diameter, 2ft. 6in.; height, 5ft. 6in.; heating surface, 24 square feet; working pressure, 100 lb. per square inch; normal evaporation from cold feed, 150 lb. per hour. It is also built as a hot-water boiler, in which case the height is reduced to 4ft. 6in. on account

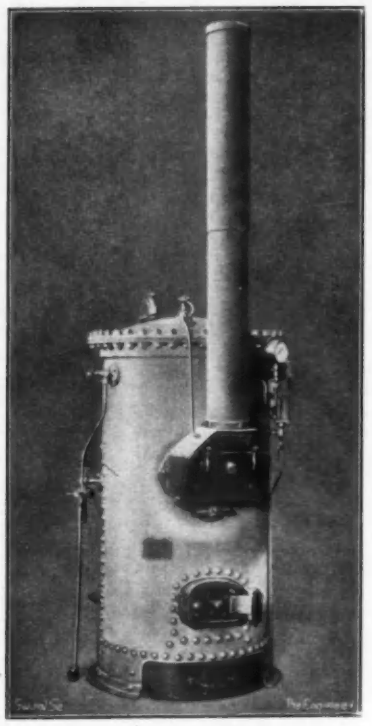


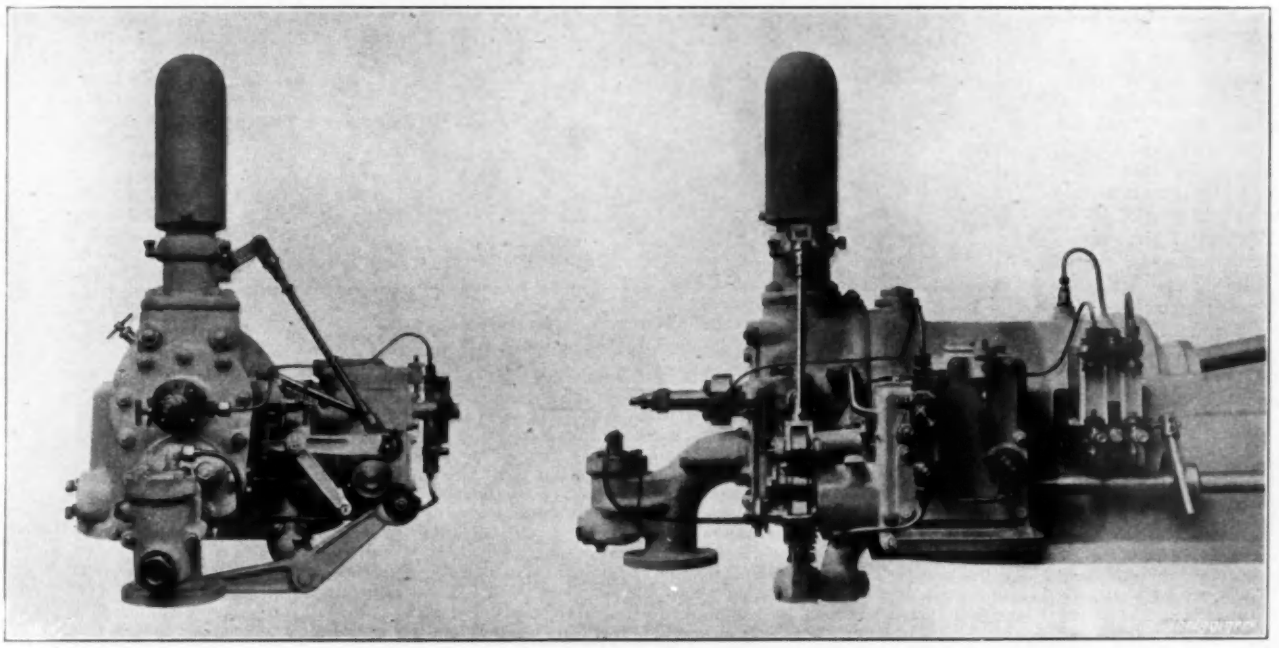
FIG. 6—COCHRANETTE BOILER

of there being no necessity for steam space, while a special fire-hole is fitted to meet banking conditions.

A. REYROLLE AND CO., LTD.

A complete range of single tubular immersion heaters which have been developed to meet the increasing demand for this type of heating unit, will be exhibited by A. Reyrolle and Co., of Hebburn-on-Tyne. These units are manufactured in seven sizes, ranging from 0·75 kW to 6 kW capacity, and are suitable for use on A.C. circuits up to 500 volts, or 250 volts D.C. circuits. For heavy loadings the units may be made up in banks of any number to give the desired capacity, and an example of one of these banks of 30 kW rating mounted on a circular flange plate is illustrated in Fig. 7, which shows the arrangement of bus-bars for connecting single-phase heaters across a three-phase, four-wire circuit.

Each tubular unit is built up on a central rod of steel, on which a number of special refractory porcelain formers are threaded, the formers having twelve equally-spaced slots in which the heating element is held. The element consists of spirals of a high-grade, high-temperature resistance wire,



FIGS. 3 AND 4—CYLINDER END OF COLD-START OIL ENGINE—MARSHALL

and the element of a standard heater is enclosed in a strong copper casing, which is normally provided with a 2in. B.S.P. thread for screwing the unit into the side of the tank. A collar is attached to the fixing nut to enable a packing washer to be used when necessary. Casings of other materials can be supplied to meet special requirements occasioned by such applications of the apparatus as the heating of chemicals, or heating under high-pressure conditions. For the latter purpose, as well as for other conditions, a bolted flange can be provided for fixing, in place of the 2in. B.S.P. thread. All elements are arranged so that they may be withdrawn from their casings for inspection without draining off the liquid from the tanks in which they operate. The single heaters

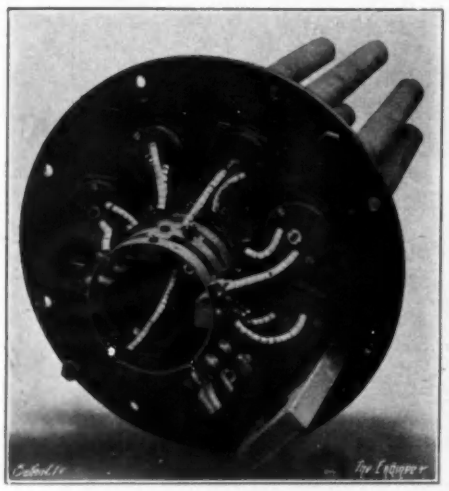


FIG. 7—HEATING UNIT—REYROLLE

are fitted with metal-clad inlet sockets, and are wired for either three-phase or single-phase circuits. The two-pin sockets on the single-phase heaters are made to British Standard Specification No. 196, and the three-pin sockets are similarly constructed. If desired, the single-phase heaters may be fitted with a three-pin socket and wired so as to give three stages of heat control. Any one of three stages can be obtained by inserting the inlet plug in one of its three positions, the contact pins being symmetrically disposed, 120 deg. apart.

Another exhibit on this firm's stand will be a ring main isolating switch—see Fig. 8—fitted with a

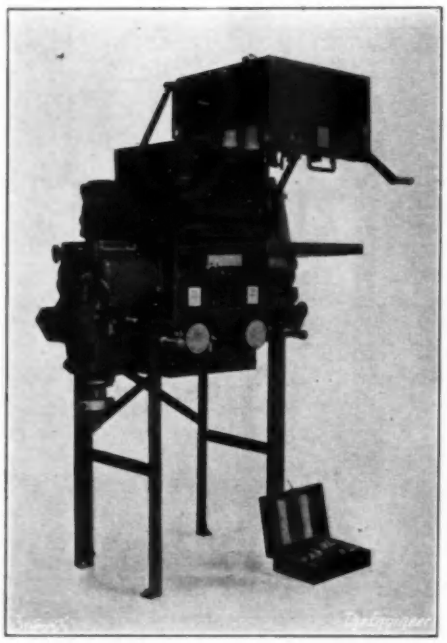


FIG. 8—ISOLATING SWITCH—REYROLLE

switch-fuse so that a connection can be easily and economically teed off a ring main to a small consumer. The isolating switches are of the oil-immersed quick-make and quick-break type, and are suitable for pressures up to 11,000 volts. Separate switches are provided for each cable of the ring main, and each of these switches can be placed in any of three positions, namely, "on," "off," and "earth," a definite stop being provided so that it is impossible to move the switch accidentally from "on" to "earth." On changing over to the "earth" position, the cable concerned is earthed and can, consequently, be handled with safety. At the same time an interlock which renders it possible to remove a cover over a testing socket is released. A plug connector can then be inserted, and after the switch has been moved to the "off" position, the cable can be tested. The interlocking is such that the switch cannot be thrown over to the "on" position if the cover is open. If the cable that is being tested should be made alive from the other end, no serious damage would result, as the testing plugs are provided with a small air-gap to discharge any excess pressure. The switch-fuse for protecting the consumer's property is oil-immersed. The fuse-elements are supported from a steel lid, which is made to swing clear of all live parts when replacements are necessary, or when it is necessary to inspect the fuse. The whole equipment is very solidly constructed and, as it is proof against flooding, it can be safely installed in underground manholes, or in other places where water is likely to invade.

In conjunction with J. H. Holmes and Co., Ltd., Reyrolle and Co., Ltd., will also be showing a set of automatic street traffic control apparatus. The equipment, which is entirely of British design and manufacture, is claimed to be superior in many ways to a number of foreign equipments that have been imported into this country, and it complies in detail with the recommendations set out in the memorandum—No. 297—recently issued by the Ministry of Transport. The lamp boxes—Fig. 9—are of welded sheet steel construction, and are fitted with either near-side or far-side cast iron hoods according to whether the boxes have to be mounted on the near or far side of the crossing. These hoods effectively screen the glasses from the sun's rays, and thus prevent the possibility of phantom signals being produced by reflection. Special diffusing glasses are used, and chromium-plated concave reflectors are mounted

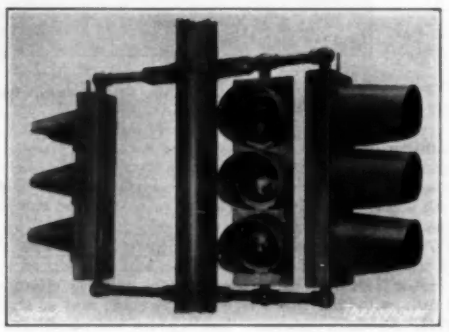


FIG. 9—TRAFFIC SIGNAL—HOLMES

behind the signal lamps, which are fitted in an upright position to ensure maximum life. Each box is capable of rotation about its vertical axis to allow of adjustment on site to suit special conditions. Brackets for pole-mounting are supplied to accommodate the necessary boxes for one-way, two-way, or three-way control. The control apparatus is housed in a cast iron box—Fig. 11—which has two compartments. One contains all the mechanism, including the driving motor, protecting fuses and isolating switch contacts, while the other contains the control handles and levers. A separate door is fitted to each compartment, so that any adjustment to the timing device can be made in safety by a policeman, or any other authorised person. The door to the main compartment is interlocked so that the isolating switch handle—in the side compartment—must be moved to the "off" position before the door can be opened. All terminals are thus rendered dead before they are exposed. For the convenience of testing, however, the switch is arranged so that it may be reclosed after the door has been opened. The timing device permits of variation of the green signal in both the main and cross street from 5 seconds to 90 seconds in increments of 5 seconds. The amber signal can be initially set for any value between 2 seconds and 10 seconds, and arrangements are made for a trailing red signal whereby the red signal is maintained during the cautionary amber period, prior to the green signal. A self-contained manual control switch is incorporated, and is interlocked with the motor control switch so that the latter must be moved to the "off" position before the hand control switch can be operated. Provision is also made to show a steady amber signal in all directions for night-time working when normal traffic has ceased. A universal motor, suitable for use on A.C. or D.C. circuits is employed to drive the timing mechanism, which is of the simplest possible type. Exceptionally heavy contacts are fitted to the contactor switches, which are suitable for operating up to twelve crossings with single-way boxes, six crossings with two-way boxes, or four with three-way boxes.

On behalf of J. H. Holmes and Co., Ltd., A. Reyrolle and Co., Ltd., will show a "Castle" direct-current electric welding set—see Fig. 11—consisting of a welding generator, an adjustable "choke," and a control board, complete with electrode holder, shield and other accessories. An electric motor drives the generator, but, alternatively, it may be driven by a prime mover, or from a line shaft, and if a direct-current supply is not available for excitation, a small auxiliary generator is provided for that purpose.

A feature of these equipments is that they can be set, within the limits of their capacity, for use with any make and size of electrode, and for any thickness of material to be welded. Once the adjustment has been made, the generator automatically controls the voltage and current of the arc so as to afford the greatest possible ease in welding, and will ensure that the arc is struck and maintained at the correct intensity even though the surface to be welded is uneven. This automatic control, the makers explain,

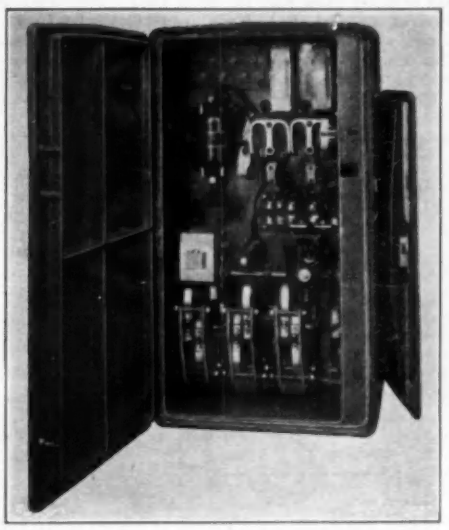


FIG. 10—CONTROL BOX—HOLMES

enables welding to be done, without risk of burning the metal and with a more intense arc than would otherwise be possible, with the result that the time required for a given weld is reduced and the quality of the weld is improved.

As the generator is designed to withstand short circuits, no current-limiting devices are required. The whole of the power developed by the generator is transmitted to the arc and used for making the weld, and the absence of intermediate resistances dispenses with the waste of power that would otherwise occur. The adjustable "choke" is incorporated in the equipment so as to prevent the electrode from sticking to the work when contact is first made.

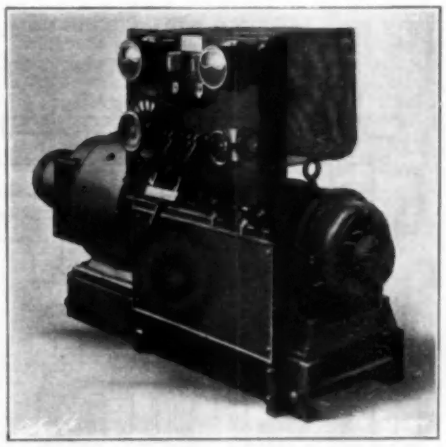


FIG. 11—WELDING SET—HOLMES

Its effect is to limit the initial flow of the current, and the operator is able to strike and draw the arc immediately and without jerk.

GRESHAM AND CRAVEN, LTD.

On the stand of Gresham and Craven, Ltd., of Ordsall-lane, Salford, Manchester, there will be found a large variety of injectors, ejectors and such like appliances, most of which are familiar to our readers; but there will also be something novel in the form of two live-steam heating injectors, which are, obviously, a very simple means of increasing the temperature of feed water at a minimum cost for apparatus and might well be installed in the inlet pipes to many economisers with the object of keeping the temperature of the economiser tubes above the dew point of the flue gases and thus preventing the corrosion of the tubes.

The devices, which are illustrated by the drawings Figs. 12 and 13, are very similar in action, except that the first is for heating only, while the second incorporates an injector.

The heater, shown in Fig. 12, is adaptable to the feed delivery pipe of any type of injector—exhaust or live steam—or to the delivery pipe from a force pump. It depends for its action on the fact that the water being fed into the boiler must be at a slightly

greater pressure than that of the steam. This excess of pressure is used to open a steam valve admitting steam to the inlet cones. The velocity of the feed water is increased by means of a suitable cone and acting as a hydraulic ejector entrains a certain amount of steam. The condensation of this steam causes a slight vacuum, which continues to draw further supplies of steam. The instrument is entirely automatic, as the auxiliary steam supply will shut itself off as soon as the pressure falls in the delivery pipe. In the case of the combined heater and injector—see Fig. 13—final feed water temperatures of 325 deg. Fah. have been attained by means of this system with steam at 180 lb. per square inch. The heating device can be fed with superheated steam if even higher temperatures are required.

Reverting to Fig. 12, it will be seen that water

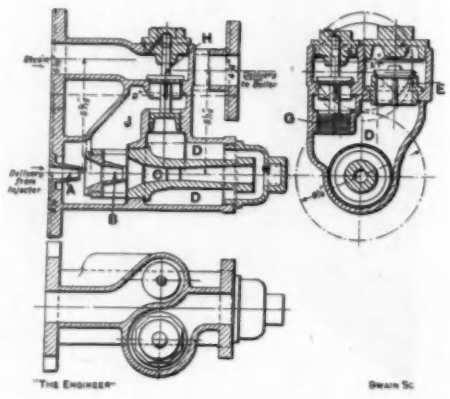


FIG. 12—WATER HEATER—GRESHAM

from the injector or feed pump passes through the feed cone A, and is given thereby sufficient velocity to enter the intermediate cone B, and from there it enters the delivery cone C and builds up sufficient pressure in the delivery chamber D to lift the back pressure valve E and so enter the boiler through the delivery pipe. Since the water has to enter the boiler against the working pressure, the pressure in the chamber D must be slightly in excess of the boiler pressure. Therefore, when this pressure acts on the piston G, it will force it up against the steam valve H, which is of the same diameter, thus allowing steam from the boiler to enter chamber J. The action of the jet from cone A passing across the gap to cone B and from cone B across the gap to cone C, induces

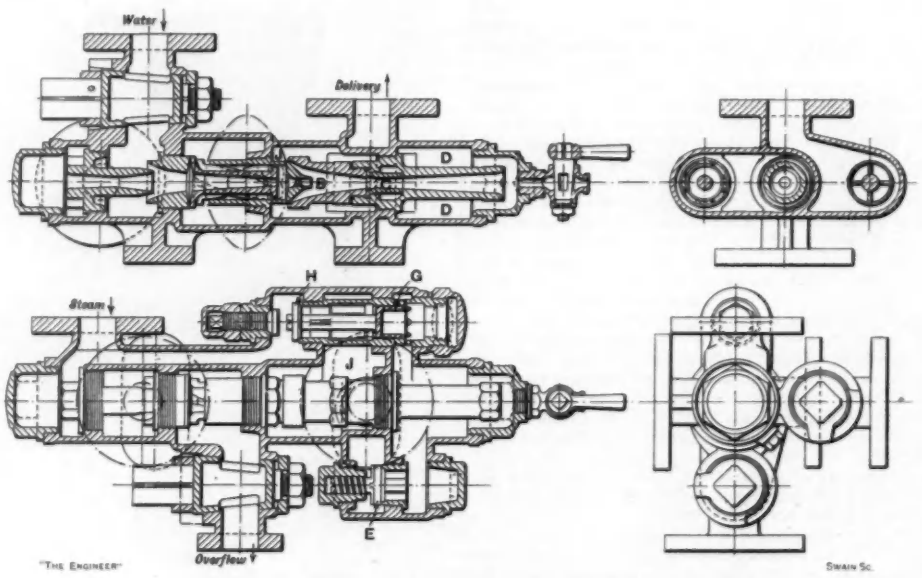


FIG. 13—COMBINED HEATER AND INJECTOR—GRESHAM

a small amount of steam to be condensed and heat up the water. The condensing of this steam causes a reduction in pressure, which again causes further steam to be entrained in the jet. By this means a very considerable increase in temperature is given to the feed water. The actual amount by which the feed water temperature is increased is governed by the pressure and temperature at which the steam is admitted, and also by the temperature of the feed water entering the cone A.

The action of the combined instrument—see Fig. 13—is very similar to that already described; the steam cone, lifting cone and combining cone remain unchanged. A short intermediate cone A is introduced to give direction to the flow of steam. The velocity of the jet from the combining cone is sufficient to cause the water to traverse the length of the secondary combining cone B and pass through the delivery cone C, so building up pressure in the chamber D. This pressure is sufficient to open the back pressure valve E against the steam pressure and to allow the water to feed forward into the boiler. The pressure in the chamber D must be slightly in excess of the boiler pressure in order that the water shall enter the boiler. This slight increase in pressure acting on the piston G is sufficient to open the valve H against the steam pressure from the steam pipe. In this case arrangements are so made that one pipe is connected to the instrument, a steam pipe being attached through a branch passage cast on the body itself. The steam passing by the valve H enters the chamber J and the action of the jet passing from the cone A to the cone B causes a certain amount of steam to be entrained. Condensation takes place, with a corresponding decrease in pressure, and further steam is induced into the water.

The automatic action of the injector is not impaired by this additional heating device, and as soon as the injector is shut off the pressure in the delivery chamber D falls, allowing the valve H to re-seat, and so shuts off the secondary steam. The injector will then restart itself, and the secondary steam will not come into action until it has built up sufficient pressure to overcome the valve H to the piston G. Approximately 100 deg. Fah. to 120 deg. Fah. can be added to the normal temperature of the feed water by this means.

There will also be on this stand a number of sectional models of injectors, and so forth.

GOODWIN, BARSBY AND CO., LTD.

It will be, we believe, the first occasion on which a portable gravel washing plant has been shown at the Fair, and it will be on the stand of Goodwin, Barsby and Co., Ltd., of St. Margaret's Ironworks, Leicester. This plant, of which we give an illustration in Fig. 14, consists of a standard type of washing barrel with a bucket elevator for feeding purposes and a screening extension. The barrel lies in an almost horizontal position and is rotated by chain and sprocket gear by a Lister petrol engine. The washing water is introduced at the end at which the gravel emerges, so that the maximum cleaning effect is produced, and is supplied by a small centrifugal pump. Water sprays are also provided in the screening section to help fine sand to pass through the holes. There are three sleeves to the screen, so that, including the oversize, four sizes are produced. The plant is capable of dealing with about 8 tons of gravel an hour.

On this stand there will also be a 12in. by 5in. brick breaker driven by a petrol engine and mounted on a four-wheeled trolley, a cast steel stone breaker and granulator mounted on wheels with a screening

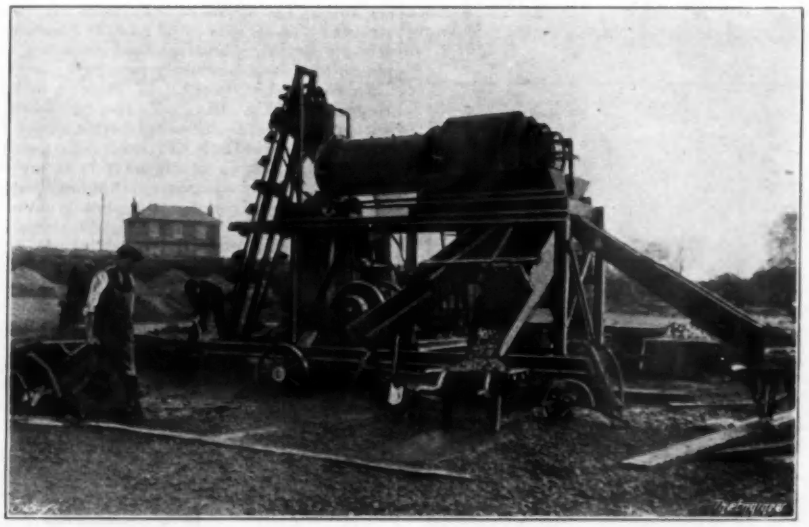


FIG. 14—GRAVEL WASHING PLANT—GOODWIN

arrangement, two concrete mixers, and a concrete block-making machine.

HOLLINGS AND GUEST, LTD.

The hot-plate press which we illustrate in Fig. 15 is to be exhibited by Hollings and Guest, Ltd., of Thimble Mill-lane, Birmingham. It is intended for the manufacture of artificial horn, fibre, Bakelite mouldings and insulating materials of all kinds. The working table of the press is of cast iron, 36in. by 30in., recessed for the ram and guided on the four columns. The press head is also of cast iron, machined on the underside to receive the hot plate. The three steel hot plates are 36in. by 30in. by 2in. thick, one being fixed to the underside of the head, the bottom

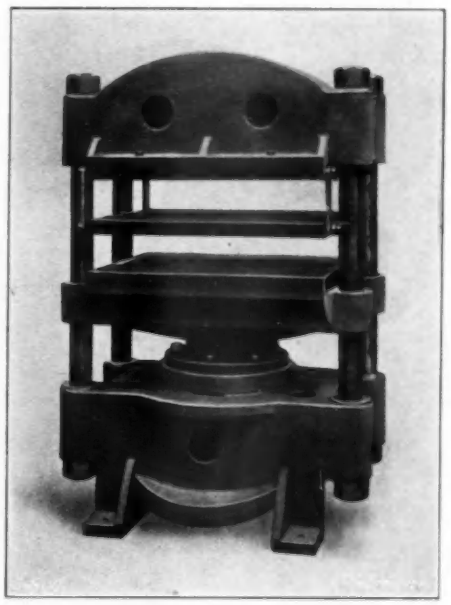


FIG. 15—HOT-PLATE PRESS—HOLLINGS

plate attached to the press table, and the intermediate hot plate being suspended between the top and bottom plates. The distance, or daylight, between the hot plates is 6in. The cylinder of the press is of cast steel, bored for the ram and gland. The ram is of cast iron, machined and polished and spigoted into the table. It has a stroke of 12in. The four press columns are of mild steel, machined all over. The steam supply is connected to the hot plates by flexible pipes. These hot-plate presses are made in various sizes and pressures according to the work required to be done. As regards the method of operation, single presses can be worked by a hand pump or power pump, and a battery of presses is more conveniently worked by means of a low-pressure water

supply for closing the press and the final high-pressure applied by means of a hand pump. In connection with this machine there will be a small ejecting press, which is intended for removing dies from their rings, and is very handy in its operation.

Another machine on this stand, which will be of especial interest to overseas visitors, will be a hydraulic girder frame press with a steel box running in and out of the press on rails, specially designed for the baling of seeds, nuts, grass, wool, cotton and similar materials. The special feature of these presses is that they are built up with steel channel framework, which makes them much lighter for transport than was the case with the old type four-column press. Either one or two steel baling boxes can be supplied and arranged

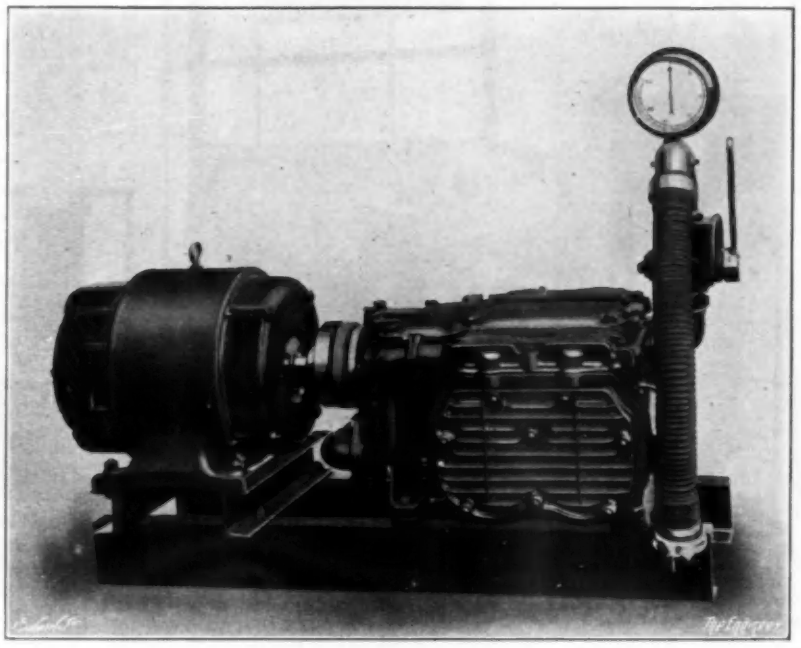


FIG. 16—VACUUM EXHAUSTER—HEATLY-GRESHAM

to run in and out of the press on rails. The baling boxes are made of dead flat steel plates, stiffened with angles and channels to ensure great strength and rigidity. The doors are fitted with quick-opening fasteners. These presses can be made to give any pressure required according to the class of material to be dealt with, and the boxes and length of stroke can, of course, be arranged to suit particular requirements. The press can be worked by hand pumps or by belt-

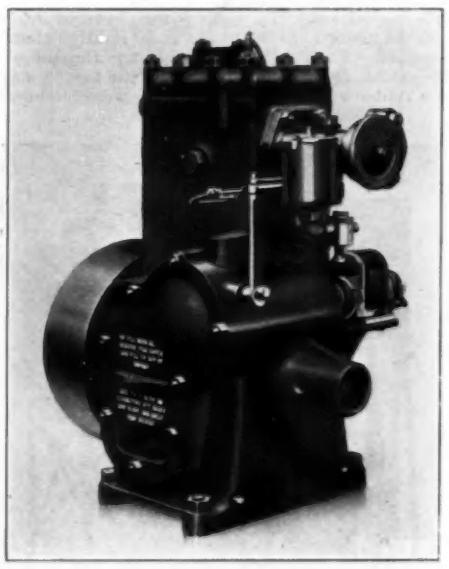


FIG. 17—2 H.P. PETROL ENGINE

driven or motor-driven power pumps, or from hydraulic mains.

Another machine worked by hydraulic power is one specially designed for removing steamship propellers from their shafts, and similar classes of work. The machine is made in segments so as to enable it to be placed around the shafts. The body and rams of the machine are of forged steel, and this enables the machine also to be kept as small and light as possible for convenience in handling, and enables it to work in a confined space. It can be operated by a hand pump, and only one inlet connection from the pump is necessary, as all the rams are connected together.

Besides these machines there will be on this stand some hydraulic pumps, an accumulator, a hand baling press for paper, rags, waste, &c., various hydraulic fittings and an example of Guest's V.R. rotary pump, which is familiar to our readers. There will also be a number of articles moulded by the Ellmar Moulding Company in Bakelite, and suchlike materials in the company's hot plate presses.

THE HEATLY-GRESHAM ENGINEERING COMPANY, LTD.

Among the exhibits of the Heatly-Gresham Engineering Company, Ltd., of Letchworth, Herts., there will be several Rational petrol engines of from 30 B.H.P. downwards, of which we illustrate in Figs. 17 and 18 the new 2 horse-power size. The 30 horse-power set will be shown running a dynamo, and two of the 2 horse-power engines, as a lighting set and driving a centrifugal pump having an output of 65 gallons per minute against a head of 25ft. There will also be the vacuum exhauster shown in Figs. 16 and 19.

The Rational engine is of the four-cycle type, having a bore of 2¾in. and a stroke of 3¼in. It gives 2 B.H.P. at 1200 r.p.m. and can be speeded to 1600 r.p.m. with safety. The cylinder and crank chamber are cast in one, and a large door is fitted to enable the

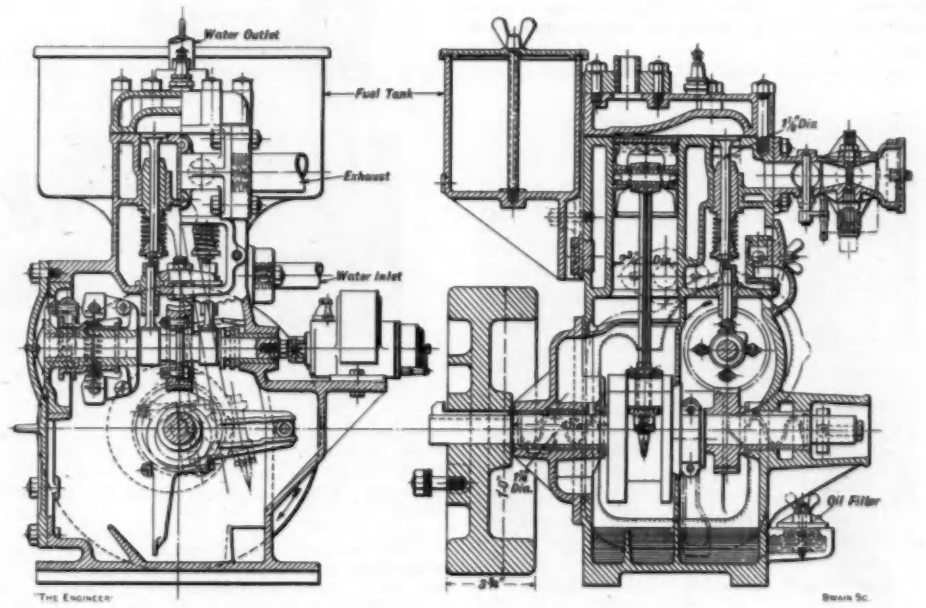


FIG. 18—2 B.H.P. PETROL ENGINE—HEATLY-GRESHAM

motion work to be withdrawn intact through this opening. The cylinder is fitted with a detachable head and so simplifies decarbonisation. The cam shaft is at right angles to the crank shaft. It is driven by skew gearing and carries at one end the magneto. The oiling is effected by the firm's patented constant level trough system, which enables the engine to run without attention for many hours.

As to the exhauster, shown in Figs. 16 and 19, it has been primarily designed for railway work and is, it will be seen, of the totally enclosed four-cylinder type. The lubrication is entirely automatic. Below the silent chain drive which connects the high-speed driving shaft with the crank shaft, there is an oil sump, and the oil from all parts of the machine drains back to this sump. The chain itself lifts the oil copiously into an upper channel, from which it flows to all the bearings of the exhauster and the surplus runs down the wall at the far end of the chamber to return to the sump. The valves used are

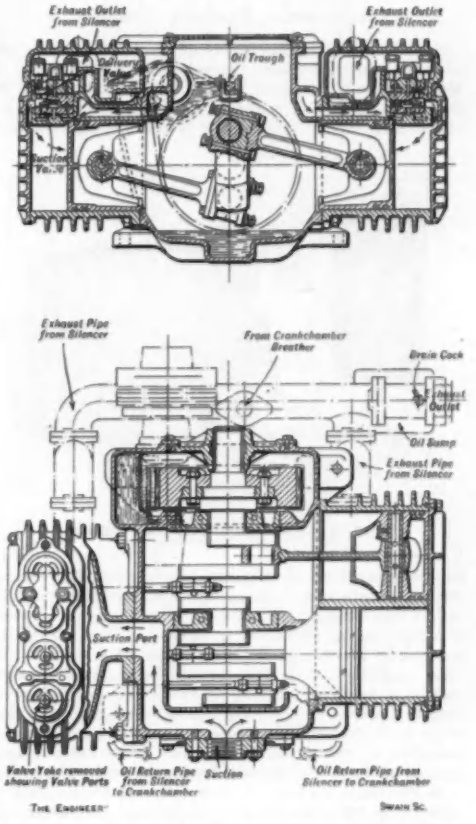


FIG. 19—VACUUM EXHAUSTER—HEATLY-GRESHAM

of the light plate type and are automatic in action. The result is that the work done on the air by the exhauster is nearly a minimum for all conditions of pressure on the suction side. The power required to handle the air varies from a low figure under free air conditions to a maximum point somewhere around 15in. of vacuum and then falls to a still lower value when the maximum vacuum is attained. To speak broadly, in the first case, with free air the indicator card is long and shallow, whereas, in the final case, it is tall and thin, and, in the intermediate stage, its width and height enclose a large area. In the case of reciprocating machines with mechanically-operated valves, or of rotary machines in which the point of opening to, and cutting off, the air are fixed positions in the cycle of operations, the work done on the air is only a minimum for one particular intake pressure, and for all other conditions power in excess of that which should be required is absorbed, showing itself in additional heating. The exhauster

under review is claimed to be free from this defect, with the consequence that its temperature rise under the worst conditions is very small and trouble due to heating is avoided.

The exhaust from these machines is passed through a silencer, which also extracts any oil that may be carried over with the air. One of them has been, we are told, run day and night without stopping for 750 hours, and needed no addition of lubricating oil.

THE GENERAL ELECTRIC COMPANY.

Some interesting examples of electric furnaces are to be exhibited by the General Electric Company, of Magnet House, Kingsway, W.C. 2. A furnace will be shown in operation annealing brass stampings, spinnings, &c. There will also be a muffle furnace and a

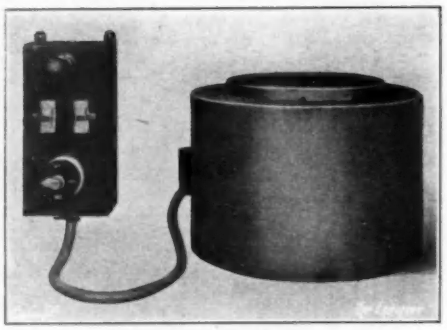


FIG. 20—LEAD MELTING POT—G.E.C.

high-temperature steel-hardening furnace, the former serving to pre-heat high-speed steel tools before they go to the hardening furnace. Another type of electric furnace to be shown in operation is designed for annealing steel and for case-hardening steel. The lead melting pot in Fig. 20 will be shown in operation. A sectional model of the Grünewald electric bright annealing plant for steel and copper strip and wire in coils will constitute another exhibit, and samples of wire and strip that have been bright annealed by this plant will be displayed on the stand.

A standard electric furnace, suitable for annealing, hardening, tempering, case-hardening, and normalising steel, and for the annealing, normalising, and the heat treatment of brass, copper, aluminium and other non-ferrous metals and alloys, is illustrated in Figs. 21 and 22. The former shows the operator pushing the charge of material from the loading shelf into the furnace, the loading shelf being of the travelling type, which greatly facilitates the loading and unloading of the furnace charge. These furnaces are heated by means of large diameter nickel-chromium wire heating elements, which are arranged along the sides and under the hearthplate of the heating chamber. The heating elements are supported in heat-resisting panels, and, if necessary, they can easily be replaced. Cast nickel-chromium element guards are fitted. The door-lifting mechanism can be on

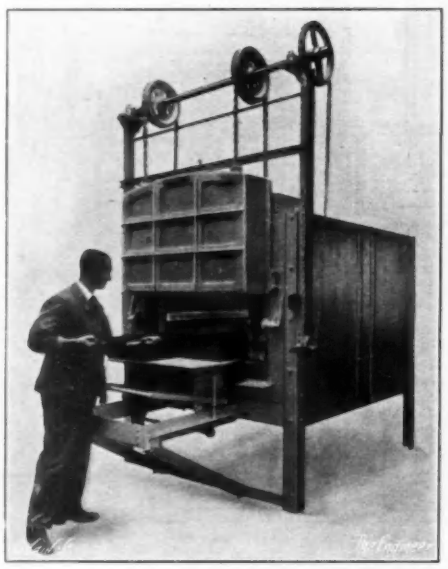


FIG. 21—ELECTRIC FURNACE—G.E.C.

either side of the furnace, and a switch is arranged to cut off the current automatically when the door is opened. A cast nickel-chromium heat-resisting plate se ves to protect the hearth. Terminal bars of adequate section to prevent overheating project through the back wall into the connection box, which also contains a gold excess temperature fuse, and, if necessary, a pyrometer can also be placed in this box. The shell of the furnace is composed of steel plates reinforced with angles and is bolted together to form a rigid structure. The legs, which may be of any desired height, are composed of cast iron, and are bolted to the body of the furnace. The heating elements are distributed so as to ensure a uniform temperature in all parts of the furnace, and another feature to which the makers direct attention is that the resistance elements give rise to a unity power

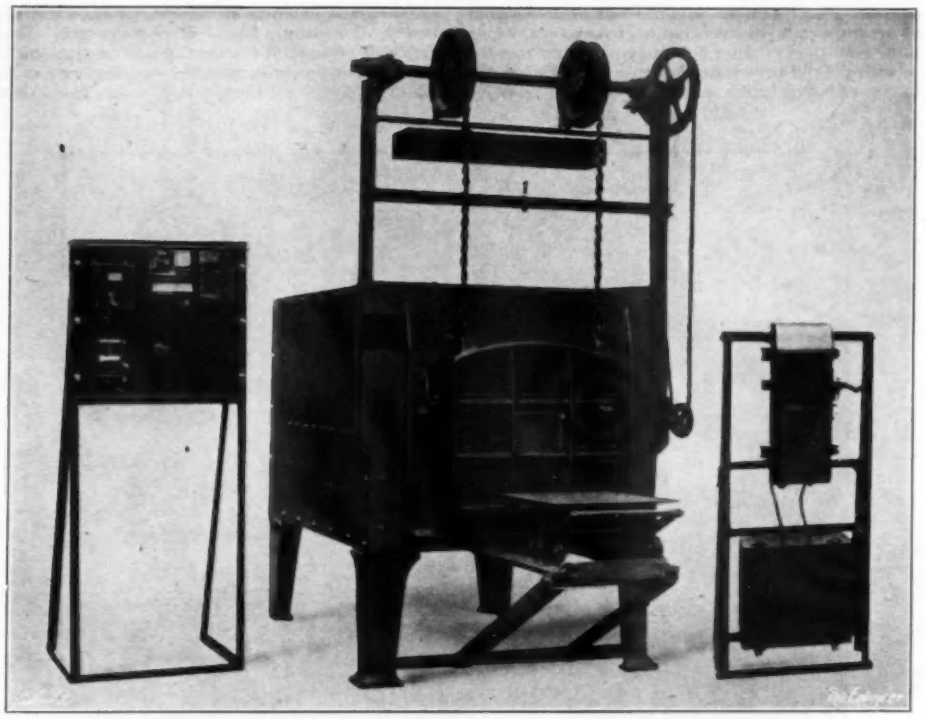


FIG. 22—FURNACE WITH AUTOMATIC CONTROL GEAR—G.E.C.

factor load which usually serves to improve the power factor of the generating plant. The maximum working temperature of these furnaces is 1000 deg. Cent., and they can be designed for any standard direct-current or alternating-current voltage, and for any periodicity.

Furnaces, as shown in Fig. 22, are made in two

FIG. 23—ELECTRIC FURNACE—G.E.C.

standard sizes, 30 and 80 kilowatts, and furnaces of these capacities are to be shown in operation, the small furnace working on brass and the larger furnace on steel. Fig. 23 shows the same type of furnace, but fitted with sway bar door-operating mechanism, and as used for vitreous enamelling in a large works in this country, whilst Fig. 24 shows a standard 8-kilowatt muffle type suitable for a maximum working temperature of 1830 deg. Fah. The muffle is composed of refractory fireclay wound with nickel-chromium wire, and arranged to give an equal temperature throughout the length of the muffle. The terminal box is at the back of the furnace and the pyrometer flange and hole are provided at this point. The illustration shows the automatic temperature control panel mounted alongside the furnace.

Turning now to the model of the Grünewald electric bright annealing plant for steel and copper strip and wire in coils, it has been found as the result of considerable experience that, provided the material is heated in a closed chamber, bright annealing can be achieved by protection against oxidation during the cooling period only, but this protection must be thorough if it is to be effective. The Grünewald method of bright annealing in "Magnet" electric furnaces is claimed to give the desired result in a very simple, practical and economical manner. Really bright annealing is said to be obtained at relatively low cost, and practically without skilled labour or supervision. The system is particularly suitable for the bright annealing of strip and wire, and the following description applies to annealing work of that nature. An annealing unit is shown in Fig. 25 where 1 is the annealing pot, 2 the refractory lining, 3 the furnace insulation, 4 a cooling water groove, 5 a rubber sealing ring, 6 eyebolts, 7 a pyrometer tube, 8 a valve, 9 the base plate and 10 suspension rods.

The coils to be annealed are placed on the base plate, the height of the stack being determined by the internal depth of the annealing pot and of the furnace. The annealing pot cover is then lowered over the stack of coils and the suspension rods which depend from it are attached to the base plate. Fig. 26 shows a furnace charge with cover and suspension rods in position. The whole is then lowered into the pot, as shown in Fig. 27, and tightly clamped together. The pot is placed into the furnace—Fig. 28—which is effectively sealed at the top by means of a rubber ring, which is cooled by water circulating

FIG. 24—MUFFLE FURNACE—G.E.C.

in narrow groove. It is found in practice that the rubber ring can be used for long periods without deterioration. As the pot and its contents are heated, a considerable portion of the air is expelled through the valve shown at 8 in Fig. 25, partly owing to expansion and partly on account of the vaporising of oil and grease which adheres to the charge. Consequently, there can be no atmospheric oxygen present in the pot when the charge reaches the temperature at which oxidisation is possible. As the temperature rises the internal pressure progressively decreases until, towards the end of the heating operation, it

permits the valve to close automatically. As a precautionary measure the valve may be screwed down firmly so as to preclude all possibility of the admission of air from without. When the charge is heated uniformly throughout, the pot is removed from the furnace and transferred to a contraflow recuperating trench where, whilst cooling, it assists in pre-heating other pots prior to their entering the electric furnace. During the cooling period the sealing device and valve prevent any leakage of air into the pot and, consequently, the charge actually

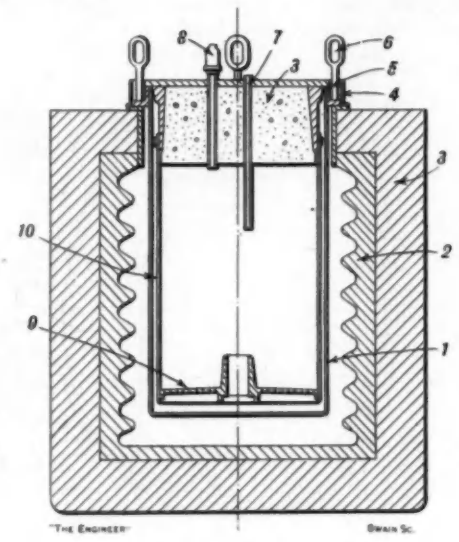


FIG. 25—ANNEALING UNIT—G.E.C.

cools in a partial vacuum. When sufficiently cool, the pot is taken from the trench and the charge lifted from the pot on its base plate, thus enabling the cover and its suspension rods to be attached to another loaded base plate.

It will be noted that the annealing pot does not stand on the bottom of the furnace, but is suspended from the top and that the weight of the charge is carried by the suspension rods, which depend from the cover and are attached to the base plate. Consequently, it is only necessary to make the pot strong

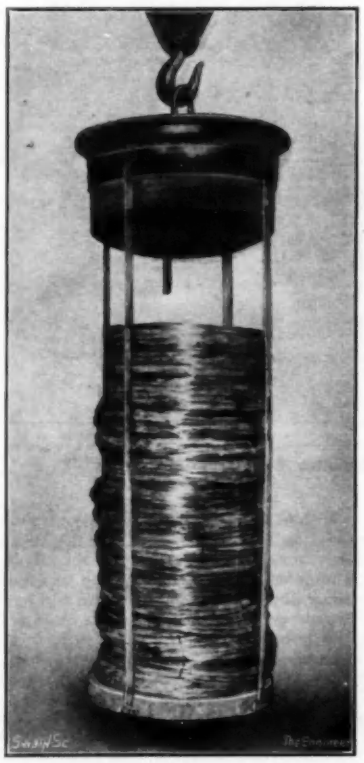


FIG. 26—COILS READY FOR ANNEALING—G.E.C.

enough to carry its own weight, thus enabling very thin pots to be used, thereby considerably reducing the volume to be heated. This is said to result in a reduction of 15 to 20 per cent. in the current consumption per charge, and in a shorter heating period and increased production capacity per furnace. Another feature of importance is that the seal is well removed from the heated zone and is protected by a considerable thickness of high-grade heat-insulating material, which enables an efficient air-tight joint to be made in a very simple manner.

Whilst the contra-flow recuperating trench—see Fig. 29—is very simple and comparatively inexpensive to construct, it effects an important economy by pre-heating the pots before they are placed in the furnace. It also accelerates the cooling of the pots containing annealed material, thereby shortening the time occupied by the complete cycle of operations.

The pots used in the process have a comparatively long life, for, owing to the fact that they are not subjected to any stress or strain, they can be kept in service until they cease to be air-tight, and even when this stage is reached, it is only necessary to replace a portion of the pot. As it is not exposed to heat and oxidation, the cover, obviously, does not require renewal, and it is therefore claimed that the cost

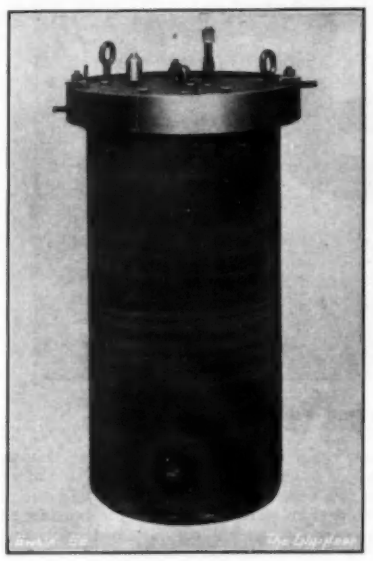


FIG. 27—ANNEALING POT—G.E.C.

of pots and covers per unit of output is but a fraction of that of the heavy steel pots and covers used in other processes.

Fig. 29 illustrates diagrammatically the simplest form of recuperating trench. It can be made to accommodate any number of pots according to the rate of cooling desired, and which can be used either with or without means for controlling the flow of air. A simple cross traversing carriage at each end of the double trench facilitates the transference of carriages from one side to the other. The arrangement of these recuperating trenches varies according to the space available and other local conditions. In the drawing

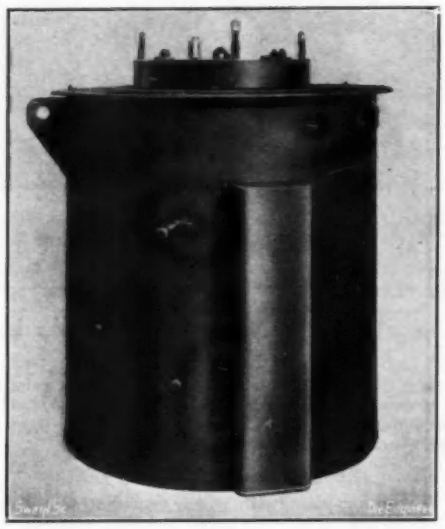


FIG. 28—ANNEALING FURNACE—G.E.C.

a is the annealing furnace with the pots, *b* the cooling side of the trench, *c* annealing pots, *d* annealing pot carriages, *e* the preheating side of the trench, *f* a partition and supporting beams, *g* air conduits, *h* the end at which hot pots enter, *j* the end at which cool pots leave, *k* the end at which cold pots enter, and *l* the end at which preheated pots leave.

In addition to the features mentioned, the process offers all the advantages of electric heating. The electric furnaces require no attention other than loading and unloading, whilst the temperature is controlled automatically within very close limits. There is a definite relationship between electrical input and heat input, a relationship which is uninfluenced by any secondary consideration. This renders it possible to work to a time schedule, and to rely upon a fixed output per working shift, or other unit of time. This process is extensively applied on a production basis under ordinary shop conditions, and is claimed to be unequalled for the treatment of iron and steel wire. It has also, we

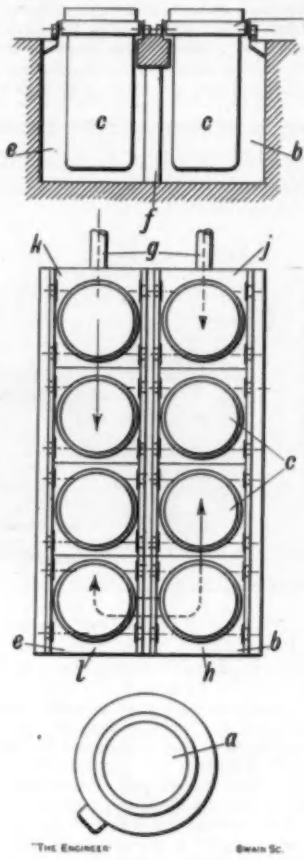


FIG. 29—RECUPERATING TRENCH—G.E. .

are informed, been applied, with conspicuous success, to non-ferrous metals.

FILM COOLING TOWERS (1925), LTD.

A cooling tower is, naturally, far too large to exhibit in its entirety at the Fair, so the firm of Film Cooling Towers, of 124, Chancery-lane, London, W.C. 2, has had to be content with the display of models, including one of the interior arrangements of one of its towers, which we illustrate in Fig. 30. The peculiar feature of the irrigating system of these towers is that it is built up of simple laths, which are set at a considerable slope, as shown in the engraving. At the ends they are notched together, so that the descending water can trickle from one lath to the next one below. The water adheres to the laths, on account of its surface tension, and forms a thin film all round them. The consequence is that a very

FIG. 30—MODEL OF COOLING TOWER—FILM

large surface is exposed to the action of the air under the most favourable conditions for cooling. At the same time the spaces between the laths form natural shafts for the ascending current of air. It is claimed for these cooling towers that they will give a greater cooling effect, with a smaller consumption of make-up water and a smaller ground area, than the usual "raining" type of tower.

ELECTRIC FURNACE COMPANY, LTD.

On the stand of the Electric Furnace Company, Ltd., of 17, Victoria-street, S.W. 1, a small high-frequency furnace, rated at 7 kVA, is to be shown. The company's high and low-frequency furnaces have,

however, recently been described in our columns, and it is scarcely necessary to consider the details of construction here. Perhaps the most original exhibit will be the poking machine shown in Fig. 31, which has been designed to accelerate the melting of brass swarf in Ajax-Wyatt and similar furnaces, and to reduce the cost of labour. The machine consists of two parts, a shaking table for the continuous charging

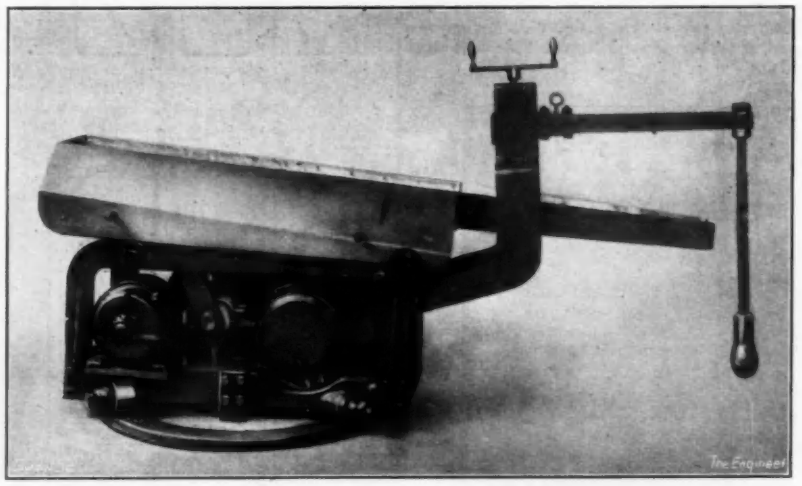


FIG. 31—POKING MACHINE—ELECTRIC FURNACE CO.

of swarf and a mechanical poking element which has a movement similar to that of a kneading machine. The makers point out that when charging small pieces of swarf by hand the work is arduous and difficult, because "scaffolding" occurs in the furnace, and a great deal of poking is necessary. With the new machine, however, the charging is carried out as a continuous and steady operation, and results in rapid melting and a saving in labour costs. As these machines are usually only required for about 20 minutes after the commencement of each charging operation, it is frequently possible to make one machine serve two adjacent furnaces. We are told that in a large brass works where these poking machines have been adopted, the number of heats in a given time has been increased by more than 20 per cent., as compared with the hand method. The power consumption per ton has been reduced by more than 5 per cent., and the cost of labour by more than 20 per cent. It is claimed that the installation of one poking machine for serving two 12-cwt. Ajax-Wyatt furnaces, melting swarf, results in a saving of several hundred pounds per annum in the cost of production.

A metal melting pot rated at 20 kVA and with a maximum melting capacity of 200 lb. of aluminium is also to be shown. A novel feature of the pot is the method of supporting the resistor element in self-aligning refractory cleats, which, in turn, are held in a heat-resisting alloy framework. By loosening three nuts the whole heating element unit may be removed bodily from the pot, thus facilitating inspection or replacements.

An air heater suitable for supplying hot air for drying purposes of all kinds will form another of the Electric Furnace Company's exhibits. In the construction of this heater no heat insulating materials are employed, for the air space between the heater unit and the external walls of the duct forms an effective heat insulating blanket.

NORRIS, HENTY AND GARDNERS, LTD.

A new type of oil engine will be shown on the stand of Norris, Henty and Gardners, Ltd., Barton Hall Engine Works, Patricroft, and is illustrated in Fig. 32, which represents one of these engines coupled with a dynamo and a small air compressor to form an auxiliary unit for oil-engined sea-going vessels or similar purposes. The whole set, it will be noticed, is quite compact, and while the dynamo is permanently coupled with the engine, there is a clutch between the shaft and the compressor, so that it can be put out of action when not required. The engine itself is of the four-cylinder type and gives 38 brake horse-power when running at 1000 revolutions per minute. It drives a dynamo, by Electromotors, Ltd., having an output of 19½ ampères at from 220 to 230 volts and the two-stage air compressor.

This engine is capable of developing about 9½ horse-power per cylinder when running at the normal speed of 1000 revolutions per minute, but can be speeded up to 1200 revolutions per minute temporarily when the power amounts to some 11½ horse-power per cylinder.

The engine is provided with a forced lubrication system which supplies oil to the main bearings, crank pins, and through the tubular connecting-rods to the gudgeon pins. The whole of the valve mechanism, including the fuel pump cams and rollers, is also supplied with oil under pressure from the main system. Governing is effected by a totally-enclosed centrifugal governor, which automatically controls the amount of fuel injected so as to suit the load on the engine at any given moment. It can be adjusted by hand whilst the engine is running, and has complete control of the engine through a speed range of from one-third to the full working speed. The engine is started from cold by means of a hand starting crank handle, compression relief gear being provided for this purpose. Two types of crank case are made for this engine, one with a flat base for stationary work and the other so fashioned that it is convenient for bolting down to the bearers for marine service and still keeps the propeller shaft as close as possible to the bottom of the boat.

On this stand there will also be a 17–19 B.H.P. heavy-oil engine of the full Diesel type, a small single-stage air compressing set for pressures up to 350 lb. per square inch, and a 20 H.P. four-cylinder lighting set, which will be at work lighting the stand.

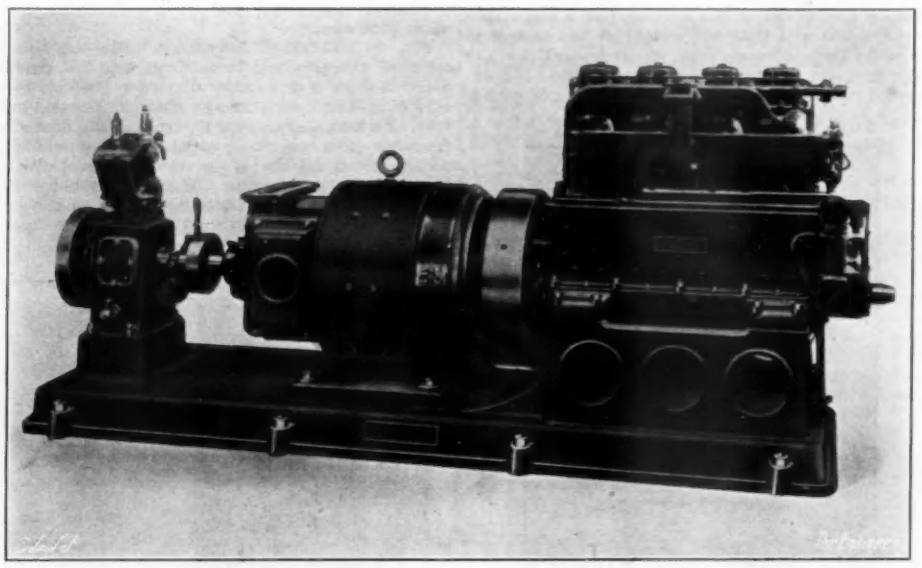


FIG. 32—COMBINED LIGHTING AND COMPRESSING SET—NORRIS, HENTY

THE AEROGRAPH COMPANY, LTD.

A working plant with which practical demonstrations of the company's spray finishing systems will be given, will be shown by the Aerograph Company, Ltd., of 43, Holborn-viaduct, London, E.C. 1. Some new types of portable painting plants will be exhibited, together with a novel form of low-pressure spray gun with an automatic paint regulator. The arrangement of this regulator is illustrated by the sketch, Fig. 33.

The merit of these low-pressure guns is that they occasion less disturbance of the painted surface, so that "rubbing" costs are reduced, while the amount of mist produced is minimised, so that the apparatus can be more safely used in confined spaces where artificial ventilation is difficult. This result is attained by the use of a hollow needle in the gun, which enables cellulose enamels and other finishing materials to be successfully applied at air pressures of from 15 lb. to 20 lb. per square inch.

The automatic paint regulator comprises a special regulating valve C—see Fig. 33—which is fitted to the pressure paint container in place of the standard hand-operated regulating valve, and a reservoir A attached to the spray gun and connected to the regulating valve C by a rubber tube B of sufficient length to reach the highest point at which the operator

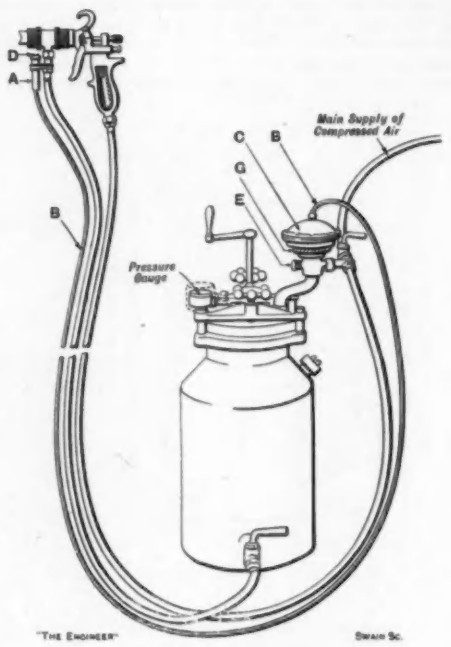


FIG. 33—PAINTING APPARATUS—AEROGRAPH

will work. The reservoir A, rubber tube B and regulating valve C are filled with water by means of the filler screw D whilst the spray gun is at the same level as the pressure paint container. The regulating valve C is then adjusted to provide the right amount of pressure on the paint in the container when the operator is working at the ground level. This adjustment is effected by screwing up the top half of the regulating valve C for higher pressures and unscrewing it for lower pressures. Only just sufficient pressure should be put on the paint to raise it in sufficient volume to the nozzle of the spray gun, and it will, the makers say, rarely be found, even with the heaviest paint, that a pressure of more than 10 lb. to 15 lb. per square inch is required at the ground level. Too much pressure results in more paint being supplied than the main compressed air can atomise efficiently, with the effect that an inferior finish will be produced.

The regulating valve C consists of a water reservoir provided with two sensitive diaphragms, and as the spray gun is raised the head of water in the reservoir A, tube B and regulating valve C increase, which depresses the top diaphragm. The lower diaphragm is also depressed through the action of a link causing the regulating valve to admit more compressed air, thus increasing the pressure on the paint. The head of water is decreased as the spray gun is lowered and the diaphragms return to their normal position. Less compressed air is therefore admitted and the surplus escapes through the needle valve E, thus reducing the pressure on the paint.